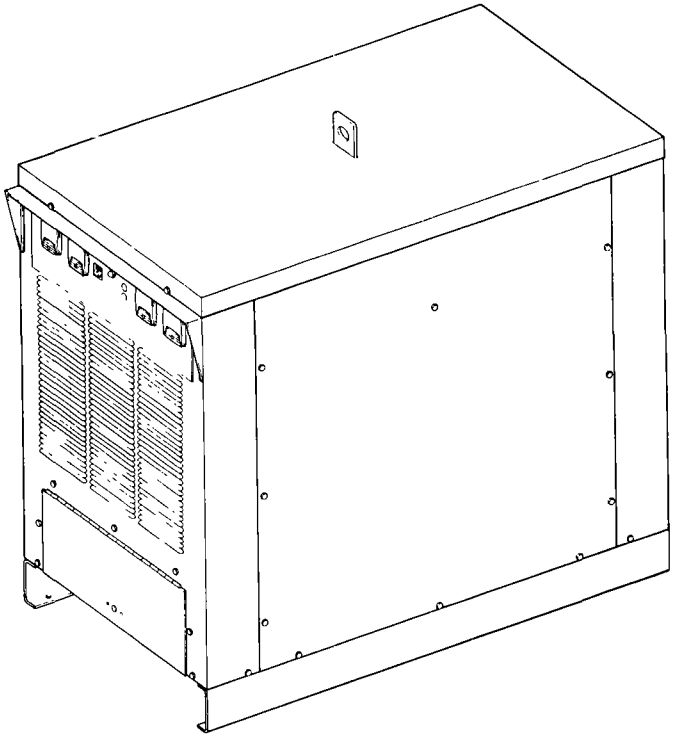
October 1981 FORM: OM-267C

Effective With Serial No. JB522183

MODEL

GPS-1000
GPS-1500A
GPS-1500V



# OWNER'S MANUAL

MILLER ELECTRIC MFG. CO.
718 S. BOUNDS ST. P.O. Box 1079
APPLETON, WI 54912 USA

ADDITIONAL COPY PRICE 55 CENTS

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PRINTED IN U.S.A.

# LIMITED WARRANTY

**EFFECTIVE: JUNE 1, 1979**

This warranty supersedes all previous MILLER warranties and is exclusive with no other guarantees or warranties expressed or implied.

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3. All welding guns and feeder/guns . . . . . 90 days
4. All other Millermatic Feeders . . . . . 1 year
5. Replacement or repair parts, exclusive of labor . 60 days
6. Batteries . . . . . 6 months

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# ERRATA SHEET

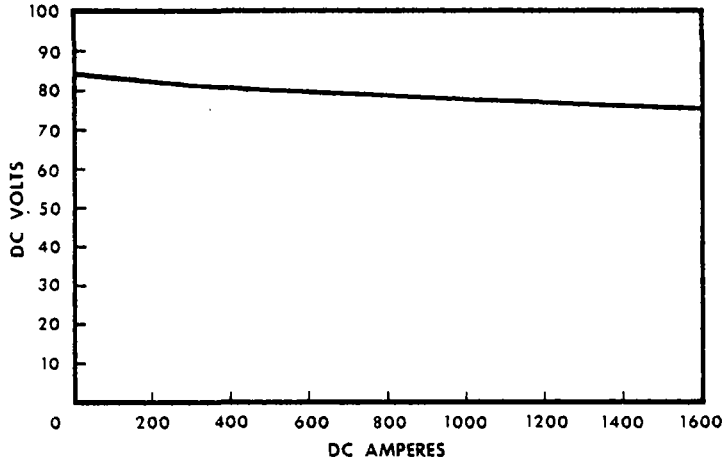
After this manual was printed, refinements in equipment design occurred. This sheet lists exceptions to data appearing later in this manual.

## AMENDMENT TO SECTION 4 - OPERATION

Add Section 4-6. VOLT-AMPERE CURVE (Figure 4-3 on this Errata Sheet)

The volt-ampere curve shows the maximum voltage and amperage output capabilities of the welding power source.

Add Figure 4-3. Volt-Ampere Curve

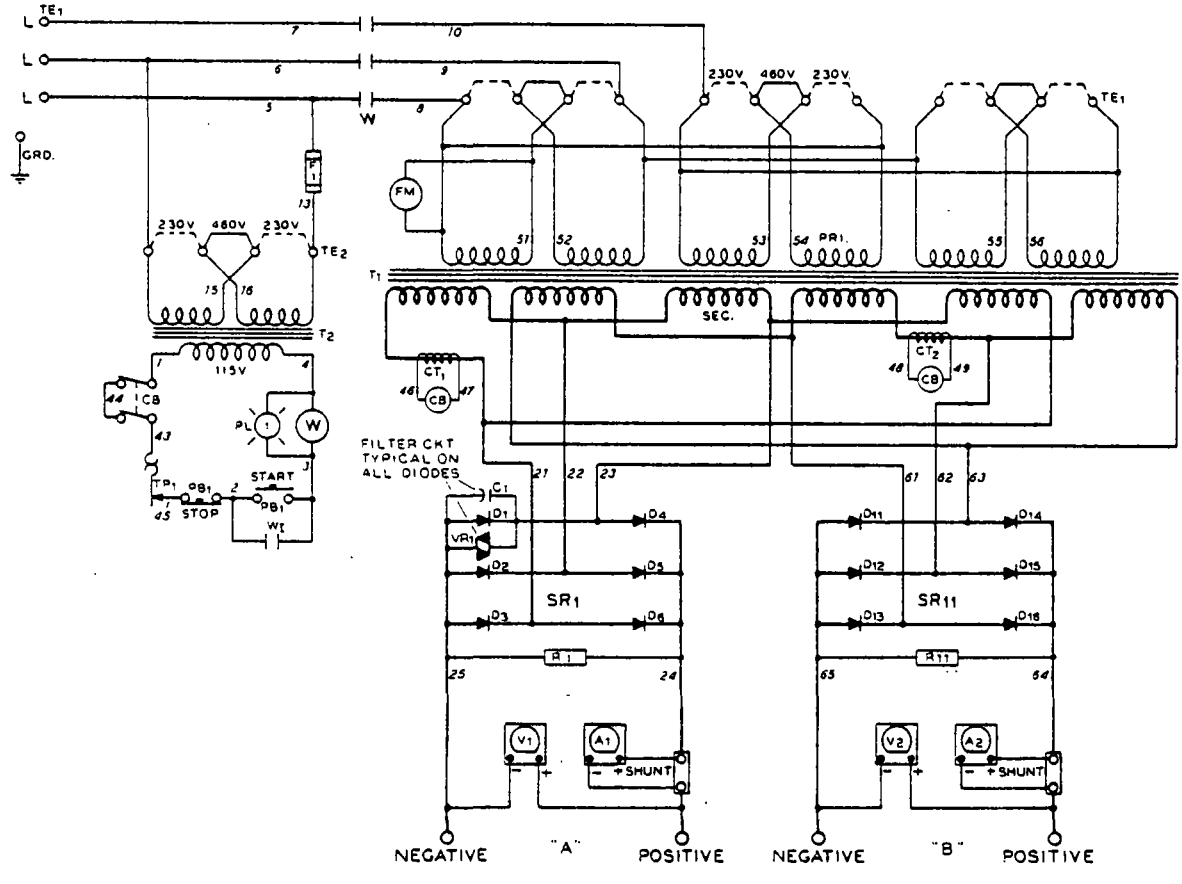



B-047 999

**Figure 4-3. Volt-Ampere Curves**

## AMENDMENT TO SECTION 6 - TROUBLESHOOTING

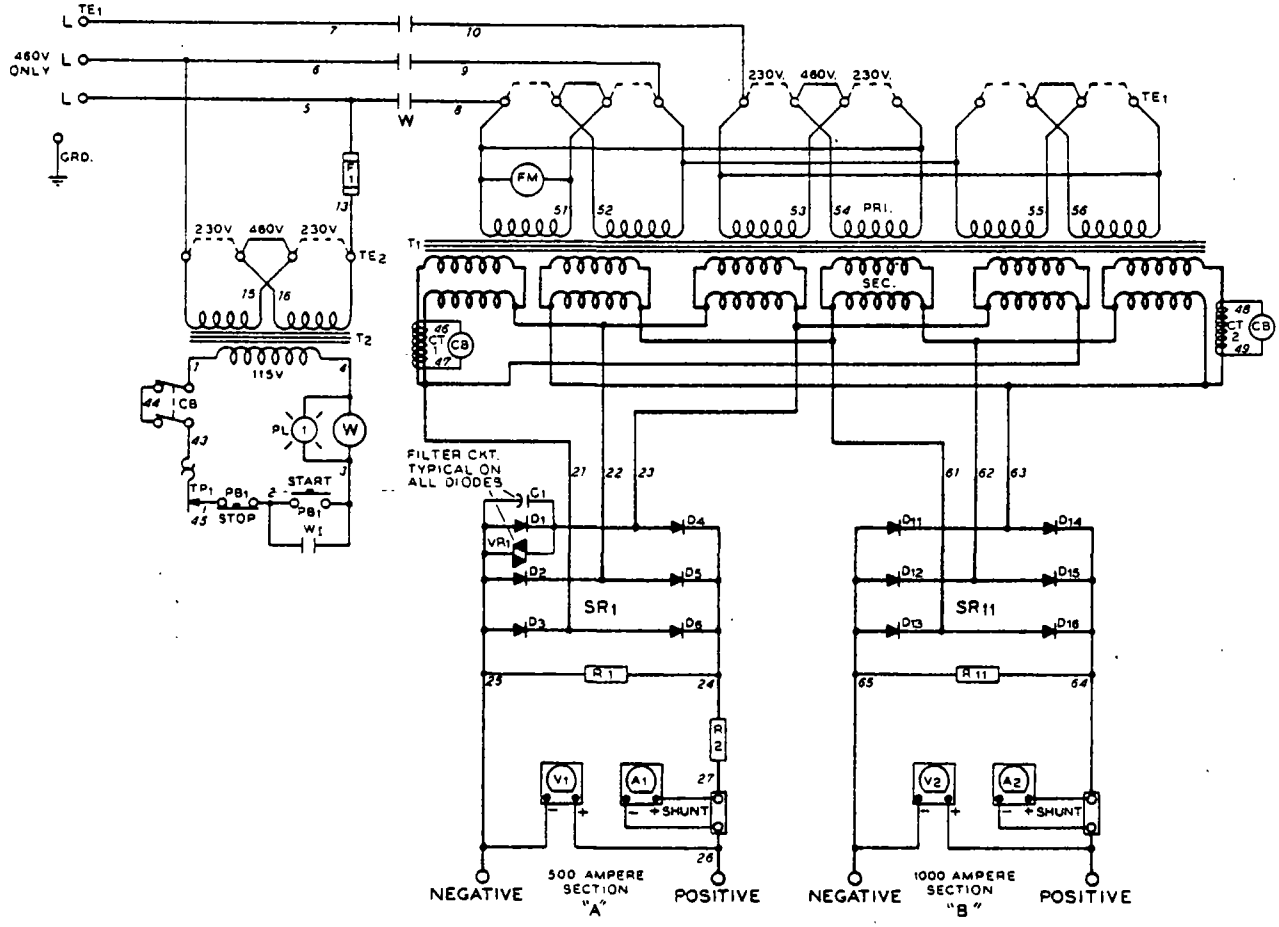
Amend Figure 6-1. Circuit Diagram For 1000 Models




**Circuit Diagram No. B-086 792**

**Figure 6-1. Circuit Diagram For 1000 Models Effective With Serial No. JC646118**

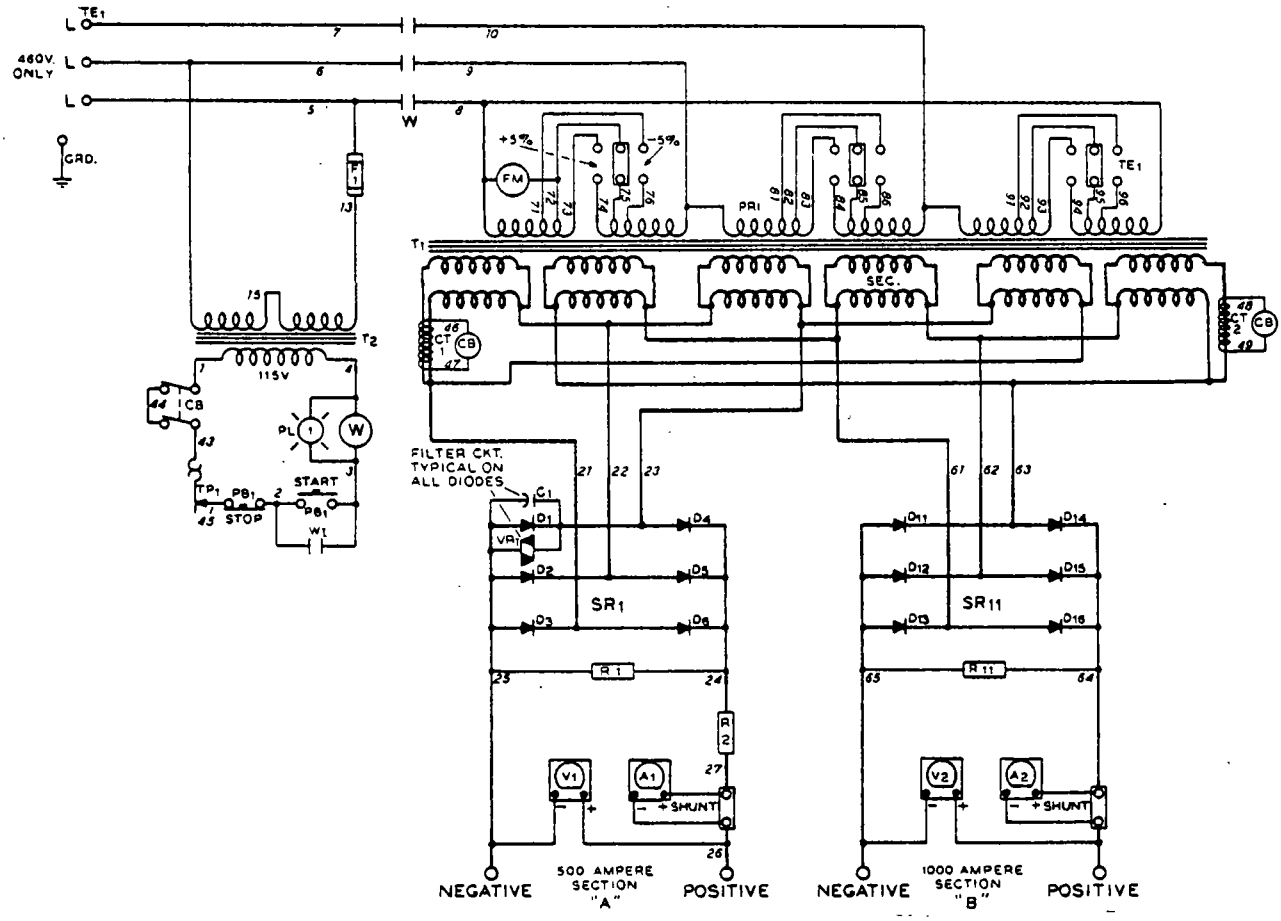
Amend Figure 6-2. Circuit Diagram For 1500A Models




Circuit Diagram No. B-088 038

**Figure 6-2. Circuit Diagram For 1500A Models Effective With Serial No. JC646118**

Amend Figure 6-3. Circuit Diagram For 1500V Models




**Circuit Diagram No. B-088 039**

**Figure 6-3. Circuit Diagram For 1500V Models Effective With Serial No. JC646118**

**Effective With Serial No. JC646118**

| Item Or Page No. | Dia. Mkgs. | Part No. | Replaced With | Description | Quantity Model 1000 | 1500A | 1500V |
|---|---|---|---|---|---|---|---|
| Pg 2 | W1 | 048 731 | 034 821 | INTERLOCK, contactor NO or NC left hand ..... | 1 | 1 | 1 |
| Pg 2 | VS1,2 | 024 471 | Deleted | | 1 | | |
| Pg 2 | VS1 | 024 471 | Deleted | | | 1 | 1 |
| Pg 2 | VR1 | | 035 645 | VARISTOR, 8 joule 150 volts ..... | 6 | 6 | 6 |
| Pg 2 | R1 | | 085 294 | RESISTOR, WW fixed 5 watt 2000 ohm ..... | 1 | 1 | 1 |
| Pg 2 | SR11 | 045 586 | 045 586 | RECTIFIER (should read) ..... | | 1 | 1 |
| Pg 2 | | 031 689 | 031 689 | CAPACITOR (should read) ..... | | 6 | 6 |
| Pg 2 | | 037 156 | 037 156 | DIODE (should read) ..... | | 18 | 18 |
| | R11 | | 085 294 | RESISTOR, WW fixed 5 watt 2000 ohm ..... | | | 1 |
| Pg 4 | R12 | 604 288 | Deleted | | | | |
| Pg 4 | SR12 | 083 719 | Deleted | | | | |
| Pg 4 | C17 | 031 640 | Deleted | | | | |
| Pg 4 | | 601 375 | Deleted | | | | |
| Pg 4 | C18 | 031 683 | Deleted | | | | |
| Pg 4 | | 044 099 | 038 980 | TERMINAL BOARD, primary ..... | | | 1 |
| 4 | | 044 100 | 038 898 | LINK, terminal - connecting ..... | | | 3 |

BE SURE TO PROVIDE MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

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# SECTION 1 - SAFETY RULES FOR OPERATION OF ARC WELDING POWER SOURCE

## 1-1. INTRODUCTION

We learn by experience. Learning safety through personal experience, like a child touching a hot stove is harmful, wasteful, and unwise. Let the experience of others teach you.

Safe practices developed from experience in the use of welding and cutting are described in this manual. Research, development, and field experience have evolved reliable equipment and safe installation, operation, and servicing practices. Accidents occur when equipment is improperly used, or maintained. The reason for the safe practices may not always be given. Some are based on common sense, others may require technical volumes to explain. It is wiser to follow the rules.

Read and understand these safe practices before attempting to install, operate, or service the equipment. Comply with these procedures as applicable to the particular equipment used and their instruction manuals, for personal safety and for the safety of others.

Failure to observe these safe practices may cause serious injury or death. When safety becomes a habit, the equipment can be used with confidence.

These safe practices are divided into two Sections: 1 - General Precautions, common to arc welding and cutting; and 2 - Arc Welding (and Cutting)(only).

Reference standards: Published Standards on safety are also available for additional and more complete procedures than those given in this manual. They are listed in the Standards Index in this manual. ANSI Z49.1 is the most complete.

The National Electrical Code, Occupational Safety and Health Administration, local industrial codes, and local inspection requirements also provide a basis for equipment installation, use, and service.

## 1-2. GENERAL PRECAUTIONS

### A. Burn Prevention

Wear protective clothing - leather (or asbestos) gauntlet gloves, hat, and high safety-toe shoes. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

Wear helmet with safety goggles or glasses with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass). This is a MUST for welding or cutting, (and chipping) to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered. See 1-3A.2.

Avoid oily or greasy clothing. A spark may ignite them.

Hot metal such as electrode stubs and workpieces should never be handled without gloves.

Medical first aid and eye treatment. First aid facilities and a qualified first aid person should be available for each shift unless medical facilities are close by for immediate treatment of flash burns of the eyes and skin burns.

Ear plugs should be worn when working on overhead or in a confined space. A hard hat should be worn when others work overhead.

Flammable hair preparations should not be used by persons intending to weld or cut.

### B. Toxic Fume Prevention

Adequate ventilation. Severe discomfort, illness or death can result from fumes, vapors, heat, or oxygen enrichment or depletion that welding (or cutting) may produce. Prevent them with adequate ventilation as described in ANSI Standard Z49.1 listed 1 in Standards index. NEVER ventilate with oxygen.

Lead -, cadmium -, zinc -, mercury -, and beryllium - bearing and similar materials, when welded (or cut) may produce harmful concentrations of toxic fumes. Adequate local exhaust ventilation must be used, or each person in the area as well as the operator must wear an air-supplied respirator. For beryllium, both must be used.

Metals coated with or containing materials that emit toxic fumes should not be heated unless coating is removed from the work surface, the area is well ventilated, or the operator wears an air-supplied respirator.

Work in a confined space only while it is being ventilated and, if necessary, while wearing an air-supplied respirator.

Gas leaks in a confined space should be avoided. Leaked gas in large quantities can change oxygen concentration dangerously. Do not bring gas cylinders into a confined space.

Leaving confined space, shut OFF gas supply at source to prevent possible accumulation of gases in the space if downstream valves have been accidently opened or left open. Check to be sure that the space is safe before re-entering it.

Vapors from chlorinated solvents can be decomposed by the heat of the arc (or flame) to form PHOSGENE, a highly toxic gas, and other lung and eye irritating products. The ultraviolet (radiant) energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form phosgene. DO NOT WELD or cut where solvent vapors can be drawn into the welding or cutting atmosphere or where the radiant energy can penetrate to atmospheres containing even minute amounts of trichloroethylene or perchloroethylene.

### C. Fire and Explosion Prevention

Causes of fire and explosion are: combustibles reached by the arc, flame, flying sparks, hot slag or heated material; misuse of compressed gases and cylinders; and short circuits.

BE AWARE THAT flying sparks or falling slag can pass through cracks, along pipes, through windows or doors, and through wall or floor openings, out of sight of the goggled operator. Sparks and slag can fly 35 feet.

To prevent fires and explosion:

Keep equipment clean and operable, free of oil, grease, and (in electrical parts) of metallic particles that can cause short circuits.

If combustibles are in area, do NOT weld or cut. Move the work if practicable, to an area free of combustibles. Avoid paint spray rooms, dip tanks, storage areas, ventilators. If the work cannot be moved, move combustibles at least 35 feet away out of reach of sparks and heat; or protect against ignition with suitable and snug-fitting, fire-resistant covers or shields.

Walls touching combustibles on opposite sides should not be welded on (or cut). Walls, ceilings, and floor near work should be protected by heat-resistant covers or shields.

Fire watcher must be standing by with suitable fire extinguishing equipment during and for some time after welding or cutting if:

a. appreciable combustibles (including building construction) are within 35 feet
b. appreciable combustibles are further than 35 feet but can be ignited by sparks
c. openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks
d. combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

Hot work permit should be obtained before operation to ensure supervisor's approval that adequate precautions have been taken.

After work is done, check that area is free of sparks, glowing embers, and flames.

An empty container that held combustibles, or that can produce flammable or toxic vapors when heated, must never be welded on or cut, unless container has first been cleaned as described in AWS Standard A6.0, listed 3 in Standards index.

This includes: a thorough steam or caustic cleaning (or a solvent or water washing, depending on the combustible's solubility) followed by purging and inerting with nitrogen or carbon dioxide, and using protective equipment as recommended in A6.0. Waterfilling just below working level may substitute for inerting.

A container with unknown contents should be cleaned (see paragraph above). Do NOT depend on sense of smell or sight to determine if it is safe to weld or cut.

Hollow castings or containers must be vented before welding or cutting. They can explode.

Explosive atmospheres. Never weld or cut where the air may contain flammable dust, gas, or liquid vapors (such as gasoline).

## D. Compressed Gas Equipment

Standard precautions. Comply with precautions in this manual, and those detailed in CGA Standard P-1, PRECAUTIONS FOR SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, listed 6 in Standards index.

1. Pressure Regulators

Regulator relief valve is designed to protect only the regulator from overpressure; it is not intended to protect any downstream equipment. Provide such protection with one or more relief devices.

Never connect a regulator to a cylinder containing gas other than that for which the regulator was designed.

Remove faulty regulator from service immediately for repair (first close cylinder valve). The following symptoms indicate a faulty regulator:

Leaks - if gas leaks externally.
Excessive Creep - if delivery pressure continues to rise with downstream valve closed.
Faulty Gauge - if gauge pointer does not move off stop pin when pressurized, nor returns to stop pin after pressure release.

Repair. Do NOT attempt repair. Send faulty regulators for repair to manufacturer's designated repair center, where special techniques and tools are used by trained personnel.

2. Cylinders

Cylinders must be handled carefully to prevent leaks and damage to their walls, valves, or safety devices:

Avoid electrical circuit contact with cylinders including third rails, electrical wires, or welding circuits. They can produce short circuit arcs that may lead to a serious accident. (See 1-3C.)

ICC or DOT marking must be on each cylinder. It is an assurance of safety when the cylinder is properly handled.

Identifying gas content. Use only cylinders with name of gas marked on them; do not rely on color to identify gas content. Notify supplier if unmarked. NEVER DEFACE or alter name, number, or other markings on a cylinder. It is illegal and hazardous.

Empties: Keep valves closed, replace caps securely; mark MT; keep them separate from FULLS and return promptly.

Prohibited use. Never use a cylinder or its contents for other than its intended use, NEVER as a support or roller.

Locate or secure cylinders so they cannot be knocked over.

Passageways and work areas. Keep cylinders clear of areas where they may be struck.

Transporting cylinders. With a crane, use a secure support such as a platform or cradle. Do NOT lift cylinders off the ground by their valves or caps, or by chains, slings, or magnets.

Do NOT expose cylinders to excessive heat, sparks, slag, and flame, etc. that may cause rupture. Do not allow contents to exceed 130°F. Cool with water spray where such exposure exists.

Protect cylinders particularly valves from bumps, falls, falling objects, and weather. Replace caps securely when moving cylinders.

Stuck valve. Do NOT use a hammer or wrench to open a cylinder valve that can not be opened by hand. Notify your supplier.

Mixing gases. Never try to mix any gases in a cylinder.

Never refill any cylinder.

Cylinder fittings should never be modified or exchanged.

3. Hose

Prohibited use. Never use hose other than that designed for the specified gas. A general hose identification rule is: red for fuel gas, green for oxygen, and black for inert gases.

Use ferrules or clamps designed for the hose (not ordinary wire or other substitute) as a binding to connect hoses to fittings.

No copper tubing splices. Use only standard brass fittings to splice hose.

Avoid long runs to prevent kinks and abuse. Suspend hose off ground to keep it from being run over, stepped on, or otherwise damaged.

Coil excess hose to prevent kinks and tangles.

Protect hose from damage by sharp edges, and by sparks, slag, and open flame.

Examine hose regularly for leaks, wear, and loose connections. Immerse pressured hose in water; bubbles indicate leaks.

Repair leaky or worn hose by cutting area out and splicing (1-2D3). Do NOT use tape.

4. Proper Connections

Clean cylinder valve outlet of impurities that may clog orifices and damage seats before connecting regulator. Except for hydrogen, crack valve momentarily, pointing outlet away from people and sources of ignition. Wipe with a clean lintless cloth.

Match regulator to cylinder. Before connecting, check that the regulator label and cylinder marking agree, and that the regulator inlet and cylinder outlet match. NEVER CONNECT a regulator designed for a particular gas or gases to a cylinder containing any other gas.

Tighten connections. When assembling threaded connections, clean and smooth seats where necessary. Tighten. If connection leaks, disassemble, clean, and retighten using properly fitting wrench.

Adapters. Use a CGA adapter (available from your supplier) between cylinder and regulator, if one is required. Use two wrenches to tighten adapter marked RIGHT and LEFT HAND threads.

Regulator outlet (or hose) connections may be identified by right hand threads for oxygen and left hand threads (with grooved hex on nut or shank) for fuel gas.

5. Pressurizing Steps:

Drain regulator of residual gas through suitable vent before opening cylinder (or manifold valve) by turning adjusting screw in (clockwise). Draining prevents excessive compression heat at high pressure seat by allowing seat to open on pressurization. Leave adjusting screw engaged slightly on single-stage regulators.

Stand to side of regulator while opening cylinder valve.

Open cylinder valve slowly so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) leave cylinder valve in following position: For oxygen, and inert gases, open fully to seal stem against possible leak. For fuel gas, open to less than one turn to permit quick emergency shutoff.

Use pressure charts (available from your supplier) for safe and efficient, recommended pressure settings on regulators.

Check for leaks on first pressurization and regularly thereafter. Brush with soap solution (capful of Ivory Liquid* or equivalent per gallon of water). Bubbles indicate leak. Clean off soapy water after test; dried soap is combustible.

### E. User Responsibilities

Remove leaky or defective equipment from service immediately for repair. See User Responsibility statement in equipment manual.

### F. Leaving Equipment Unattended

Close gas supply at source and drain gas.

### G. Rope Staging-Support

Rope staging-support should not be used for welding or cutting operation; rope may burn.

## 1-3. ARC WELDING

Comply with precautions in 1-1, 1-2, and this section. Arc Welding, properly done, is a safe process, but a careless operator invites trouble. The equipment carries high currents at significant voltages. The arc is very bright and hot. Sparks fly, fumes rise, ultraviolet and infrared energy radiates, weldments are hot, and compressed gases may be used. The wise operator avoids unnecessary risks and protects himself and others from accidents. Precautions are described here and in standards referenced in index.

### A. Burn Protection

Comply with precautions in 1-2.

The welding arc is intense and visibly bright. Its radiation can damage eyes, penetrate lightweight clothing, reflect from light-colored surfaces, and burn the skin and eyes. Skin burns resemble acute sunburn, those from gas-shielded arcs are more severe and painful. DON'T GET BURNED; COMPLY WITH PRECAUTIONS.

1. Protective Clothing

Wear long-sleeve clothing (particularly for gas-shielded arc) in addition to gloves, hat, and shoes (1-2A). As necessary, use additional protective clothing such as leather jacket or sleeves, flame-proof apron, and fire-resistant leggings. Avoid outergarments of untreated cotton.

Bare skin protection. Wear dark, substantial clothing. Button collar to protect chest and neck and button pockets to prevent entry of sparks.

2. Eye and Head Protection

Protect eyes from exposure to arc. NEVER look at an electric arc without protection.

Welding helmet or shield containing a filter plate shade no. 12 or denser must be used when welding. Place over face before striking arc.

Protect filter plate with a clear cover plate.

Cracked or broken helmet or shield should NOT be worn; radiation can pass through to cause burns.

Cracked, broken, or loose filter plates must be replaced IMMEDIATELY. Replace clear cover plate when broken, pitted, or spattered.

Flash goggles with side shields MUST be worn under the helmet to give some protection to the eyes should the helmet not be lowered over the face before an arc is struck. Looking at an arc momentarily with unprotected eyes (particularly a high intensity gas-shielded arc) can cause a retinal burn that may leave a permanent dark area in the field of vision.

3. Protection of Nearby Personnel

Enclosed welding area. For production welding, a separate room or enclosed bay is best. In open areas, surround the operation with low-reflective, non-combustible screens or panels. Allow for free air circulation, particularly at floor level.

Viewing the weld. Provide face shields for all persons who will be looking directly at the weld.

Others working in area. See that all persons are wearing flash goggles.

Before starting to weld, make sure that screen flaps or bay doors are closed.

### B. Toxic Fume Prevention

Comply with precautions in 1-2B.

Generator engine exhaust must be vented to the outside air. Carbon monoxide can kill.

### C. Fire and Explosion Prevention

Comply with precautions in 1-2C.

Equipment's rated capacity. Do not overload arc welding equipment. It may overheat cables and cause a fire.

Loose cable connections may overheat or flash and cause a fire.

Never strike an arc on a cylinder or other pressure vessel. It creates a brittle area that can cause a violent rupture or lead to such a rupture later under rough handling.

### D. Compressed Gas Equipment

Comply with precautions in 1-2D.

### E. Shock Prevention

Exposed hot conductors or other bare metal in the welding circuit, or in ungrounded, electrically-HOT equipment can fatally shock a person whose body becomes a conductor. DO NOT STAND, SIT, LIE, LEAN ON, OR TOUCH a wet surface when welding, without suitable protection.

To protect against shock:

Keep body and clothing dry. Never work in damp area without adequate insulation against electrical shock. Stay on a dry duckboard, or rubber mat when dampness or sweat can not be avoided. Sweat, sea water, or moisture between body and an electrically HOT part - or grounded metal - reduces the body surface electrical resistance, enabling dangerous and possibly lethal currents to flow through the body.

1. Grounding the Equipment

When installing, connect the frames of each unit such as welding power source, control, work table, and water circulator to the building ground. Conductors must be adequate to carry ground currents safely. Equipment made electrically HOT by stray current may shock, possibly fatally. Do NOT GROUND to electrical conduit, or to a pipe carrying ANY gas or a flammable liquid such as oil or fuel.

Three-phase connection. Check phase requirement of equipment before installing. If only 3-phase power is available, connect single-phase equipment to only two wires of the 3-phase line. Do NOT connect the equipment ground lead to the third (live) wire, or the equipment will become electrically HOT - a dangerous condition that can shock, possibly fatally.

Before welding, check ground for continuity. Be sure conductors are touching bare metal of equipment frames at connections.

If a line cord with a ground lead is provided with the equipment for connection to a switchbox, connect the ground lead to the grounded switchbox. If a three-prong plug is added for connection to a grounded mating receptacle, the ground lead must be connected to the ground prong only. If the line cord comes with a three-prong plug, connect to a grounded mating receptacle. Never remove the ground prong from a plug, or use a plug with a broken off ground prong.

*Trademark of Proctor & Gamble.

2. Electrode Holders

Fully insulated electrode holders should be used. Do NOT use holders with protruding screws.

3. Connectors

Fully insulated lock-type connectors should be used to join welding cable lengths.

4. Cables

Frequently inspect cables for wear, cracks and damage. IMMEDIATELY REPLACE those with excessively worn or damaged insulation to avoid possibly - lethal shock from bared cable. Cables with damaged areas may be taped to give resistance equivalent to original cable.

Keep cable dry, free of oil and grease, and protected from hot metal and sparks.

5. Terminals And Other Exposed Parts

Terminals and other exposed parts of electrical units should have insulating covers secured before operation.

6. Electrode Wire

Electrode wire becomes electrically HOT when the power switch of gas metal-arc welding equipment is ON and welding gun trigger is pressed. Keep hands and body clear of wire and other HOT parts.

7. Safety Devices

Safety devices such as interlocks and circuit breakers should not be disconnected or shunted out.

Before installation, inspection, or service, of equipment, shut OFF all power and remove line fuses (or lock or red-tag switches) to prevent accidental turning ON of power. Disconnect all cables from welding power source, and pull all 115 volts line-cord plugs.

Do not open power circuit or change polarity while welding. If, in an emergency, it must be disconnected, guard against shock burns, or flash from switch arcing.

Leaving equipment unattended. Always shut OFF and disconnect all power to equipment.

Power disconnect switch must be available near the welding power source.

## 1-4. STANDARDS BOOKLET INDEX

For more information, refer to the following standards or their latest revisions and comply as applicable:

1. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING obtainable from the American Welding Society, 2501 NW 7th St., Miami, Fla. 33125.

2. ANSI Standard Z87.1, SAFE PRACTICE FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

3. American Welding Society Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable same as item 1.

4. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING AND CUTTING, obtainable from the National Fire Protection Association, 470 Atlantic Avenue, Boston, Mass. 02210.

5. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable same as item 4.

6. CGA Pamphlet P-1. SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 500 Fifth Avenue, New York, N. Y. 10036.

7. OSHA Standard 29 CFR, Part 1910, Subpart Q, WELDING, CUTTING AND BRAZING.

## SECTION 2 - INTRODUCTION

| Model | Rated Welding Current Amperes 100% Duty Cycle | Max. Open-Circuit Voltage | Input At Rated Load Output 60 Hz. Three-Phase | | | | | Dimensions | Weight | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Amperes At | | | kva | kw | | Net | Ship |
| | | | 230V | 460V | 575V | | | | | |
| 1000 | 1000 @ 76 Volts | 85 | 224 | 112 | 90 | 89 | 85 | Height - 41-1/8 in. (1045 mm)<br>Width - 27-1/4 in. (692 mm)<br>Depth - 46 in. (1168 mm) | 896 lbs. (406 kg) | 986 lbs. (447 kg) |
| 1500 | 1500 @ 76 Volts | 85 | 330 | 165 | 132 | 131 | 123 | Height - 41-1/8 in. (1045 mm)<br>Width - 27-1/4 in. (692 mm)<br>Depth - 46 in. (1168 mm) | 1068 lbs. (484 kg) | 1158 lbs. (525 kg) |

**Figure 2-1. Specifications**

**2-1. GENERAL** - This manual has been prepared especially for use in familiarizing personnel with the design, installation, operation, maintenance, and troubleshooting of this equipment. All information presented herein and on various labels, tags, and plates on the unit should be given careful consideration to assure optimum performance of this equipment.

**2-2. RECEIVING-HANDLING** - Prior to installing this equipment, clean all packing material from around the unit and carefully inspect for any damage that may have occurred during shipment. Any claims for loss or damage that may have occurred in transit must be filed **by the purchaser with the carrier.** A copy of the bill of lading will be furnished by the manufacturer on request if occasion to file claim arises.

When requesting information concerning this equipment, it is essential that Model Description and/or Stock Number and Serial (or Style) Numbers of the equipment be supplied.

**2-3. DESCRIPTION** - This welding power source incorporates a three phase Delta connected, constant potential (CP) type main power transformer to provide the constant voltage output required to operate the resistance grid welding stations connected to the unit.

**2-4. SAFETY** - Before the equipment is put into operation, the safety section at the front of this manual should be read completely.

This will help avoid possible injury due to misuse or improper welding applications.

The following definitions apply to CAUTION, IMPORTANT, and NOTE blocks found throughout this manual:

**CAUTION:** *Under this heading, installation, operating, and maintenance procedures or practices will be found that if not carefully followed may create a hazard to personnel.*

**IMPORTANT:** *Under this heading, installation, operating, and maintenance procedures or practices will be found that if not carefully followed may result in damage to equipment.*

**NOTE:** *Under this heading, explanatory statements will be found that need special emphasis to obtain the most efficient operation of the equipment.*

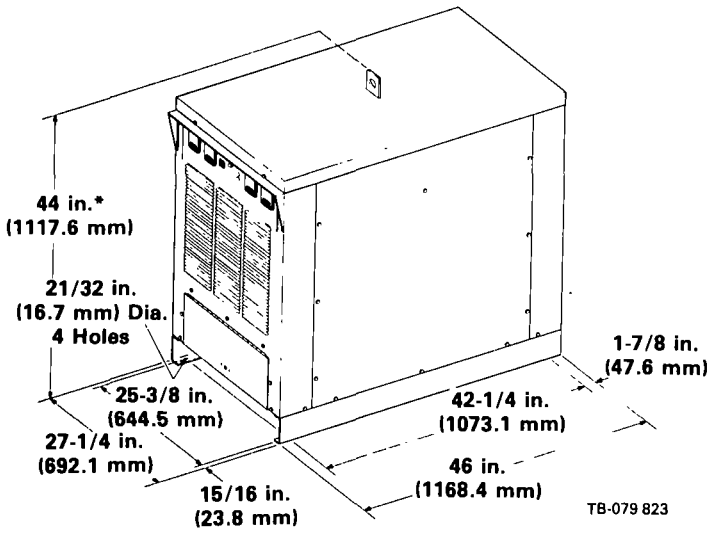
## SECTION 3 - INSTALLATION

**3-1. LOCATION (Figure 3-1)** - A proper installation site should be selected for the welding power source if the unit is to provide dependable service, and remain relatively maintenance free.

A proper installation site permits freedom of air movement into and out of the welding power source, and also least subjects the unit to dust, dirt, moisture, and corrosive vapors. A minimum of 18 inches (457 mm) of unrestricted space must be maintained between the welding power source front and rear panels and the nearest obstruction. Also, the underside of the welding power source must be kept completely free of obstructions. The installation site should also permit easy removal of the welding power source outer enclosure for maintenance functions.

**IMPORTANT:** *Do not place any filtering device over the intake air passages of the welding power source as this would restrict the volume of intake air and thereby subject the welding power source internal components to an overheating condition and subsequent failure. Warranty is void if any type of filtering device is used.*

Holes are provided in the welding power source base for mounting purposes. Figure 3-1 gives overall dimensions and the base mounting hole layout.




*Including 2-7/8 in. (73 mm) Lifting Eye

**Figure 3-1. Overall Dimensions And Base Mounting Hole Layout**

On most welding power sources a lifting device is provided for moving the unit. However, if a fork lift vehicle is used for lifting the unit, be sure that the lift forks are long enough to extend completely under the base.

**IMPORTANT:** *The use of lift forks too short to extend out of the opposite side of the base will expose internal components to damage should the tips of the lift forks penetrate the bottom of the unit.*

## 3-2. ELECTRICAL INPUT CONNECTIONS

### A. Electrical Input Requirements

This welding power source is designed to be operated from a three-phase, 60 Hertz, ac power supply which has a line voltage rating that corresponds with one of the electrical input voltages shown on the nameplate. Consult the local electric utility if there is any question about the type of electrical system available at the installation site or how proper connections to the welding power source are to be made.

### B. Input Conductor Connections

**NOTE:** *It is recommended that a line disconnect switch be installed in the input circuit to the welding power source. This would provide a safe and convenient means to completely remove all electrical power from the welding power source whenever it is necessary to perform any internal function on the unit.*

**CAUTION:** *Before making electrical input connections to the welding power source, "machinery lockout procedures" should be employed. If the connection is to be made from a line disconnect switch, the switch should be padlocked in the open position. If the connection is made from a fuse box, remove the fuses from the box and padlock the cover in the closed position. If the unit is connected to a circuit breaker, or other disconnecting device without locking facilities, attach a red tag to the device to warn others that the circuit is being worked on.*

**CAUTION:** *Connect the input conductors to the welding power source before making connections to the three-phase power supply.*

The input conductors should be covered with an insulating material which conforms to local electrical standards. Table 3-1 is provided only as a guide for selecting the proper size input conductors and fuses.

**Table 3-1. Input Conductor And Fuse Sizes**

| Input Conductor Size - AWG* | | | | Fuse Size In Amperes | | |
|---|---|---|---|---|---|---|
| Model | 230V | 460V | 575V | 230V | 460V | 575V |
| 1000 Amperes | 4/0 (2) | 2 (8) | 4 (8) | 350 | 175 | 125 |
| 1500 Amperes | 400 MCM (1/0) | 2/0 (4) | 1/0 (6) | 500 | 250 | 225 |

*Input conductor sizes are based on National Electrical Code specifications for allowable ampacities of insulated copper conductors, having a temperature rating of 75°C, with not more than three conductors in a raceway or cable. Numbers in ( ) are equipment ground conductor sizes.

Insert the three input conductors plus one ground conductor through the access hole on the rear panel. This hole will accept standard conduit fittings. See Figure 3-2 for hole location and size.

Connect the three input conductors to the line terminals on the contactor. Connect the ground conductor to the terminal labeled GROUND on the frame near the contactor. The remaining end of the ground conductor should be connected to a proper ground. Use a grounding method that is acceptable to the local electrical inspection authority.

**CAUTION:** *The ground terminal is connected to the welding power source chassis and is for grounding purposes only. Do not connect a conductor from the ground terminal to any one of the line terminals as this will result in an electrically energized welding power source chassis.*

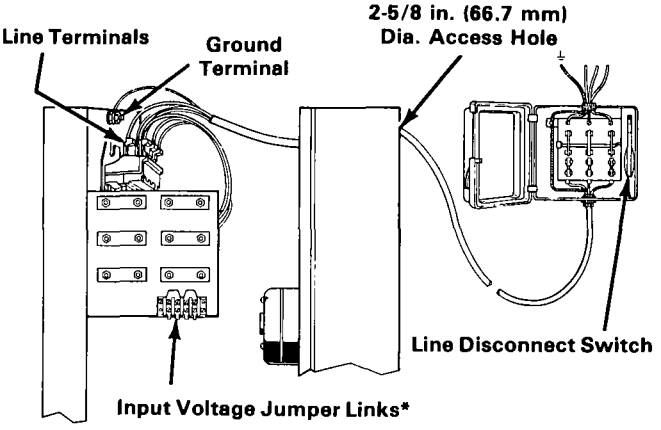



**Figure 3-2. Input Conductor Connections**

### C. Matching The Welding Power Source To The Available Input Voltage

1. For 1000 And 1500 Models

The input voltage jumper links provided on the primary terminal board permit the welding power source to be

operated from various line voltages. The various voltages from which this unit may be operated are stated on the nameplate and on the input voltage label. The input voltage jumper links are positioned for the highest of the voltages stated on the nameplate. If the welding power source is to be operated from a line voltage which is lower than the highest voltage for which the unit was designed, the jumper links will have to be moved to the proper positions before operating the unit. Figure 3-3 shows the various positions of the jumper links on the standard welding power source. If the input voltges on the nameplate differ from those shown in Figure 3-3, the input voltage jumper links must be positioned as shown on the input voltage label.

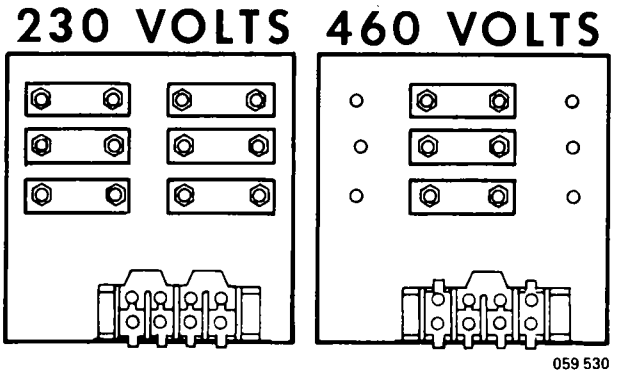



**Figure 3-3. Input Voltage Jumper Link Arrangement**

**NOTE:** *If only one jumper link is required on each of the grouped terminals, it is recommended that the unused jumper links be placed across the terminals which are to be used. This will prevent losing the jumper links which are not required for this connection.*

2. For 1500V Models

The primary of the main transformer has three selection taps to allow compensation for a high or low incoming line voltage. Selection is made at the primary terminal board. The taps on the primary terminal board are marked in percentage: +5%, 0, and -5%. If the line voltage is high, the +5% tap would be used. If line voltage is low, the -5% tap would be used.

**IMPORTANT:** *All three jumper links on the primary terminal board must be connected for the same percent compensation.*

The welding power source is shipped from the factory with the links set at zero percent compensation. Thus, if line voltage is relatively close to the requirement, the position of the jumper links need not to be changed.

**3-3. WELD OUTPUT CONNECTIONS (Figure 3-5)** - To obtain the full rated output from this unit, it is necessary to select, install, and maintain proper welding cables. Failure to comply in any of these areas may result in less than satisfactory welding performance.

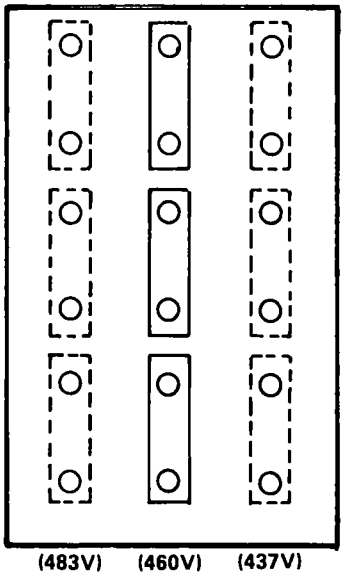



**Figure 3-4. Line Voltage Compensation Selection Taps For 1500V Models**

**CAUTION:** *Ensure that the unit is completely shut down before making any weld output connections.*

### A. Location

The POSITIVE and NEGATIVE weld output terminals are located on the lower portion of the front panel.

### B. Welding Cables

If welding cables were not ordered with this unit, the steps listed should be followed to ensure the best welding performance:

1. It is recommended that the welding cables be kept as short as possible, be placed close together, and be of adequate current carrying capacity. The resistance of the welding cables and connections causes a voltage drop which is added to the voltage of the arc. Excessive cable resistance may result in overloading as well as reducing the maximum current output capability of this unit. Proper operation is to a great extent dependent on the use of welding cables and connections that are in good condition and of adequate size.

2. Use Table 3-2 as a guide for selecting cable size for the anticipated maximum weld current which will be used. Table 3-2 shows total cable length from the welding power source to the resistance grid welding station. Select the size cable that is recommended for the maximum weld current that is to be used.

3. Do not use damaged or frayed cables.

4. Use correct lugs on the weld cables to connect them to the weld output terminals.

5. Ensure that all connections are clean and tight.

**Table 3-2. Welding Cable Size**

| Welding Amperes, DC | * Total Length Of Cable (Copper) In Weld Circuit | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 |
| 100 | 4 | 4 | 2 | 2 | 2 | 1 | 1/0 | 1/0 |
| 150 | 2 | 2 | 2 | 1 | 1/0 | 2/0 | 3/0 | 3/0 |
| 200 | 1 | 1 | 1 | 1/0 | 2/0 | 3/0 | 4/0 | 4/0 |
| 250 | 1/0 | 1/0 | 1/0 | 2/0 | 3/0 | 4/0 | 2-2/0 | 2-2/0 |
| 300 | 2/0 | 2/0 | 2/0 | 3/0 | 4/0 | 2-2/0 | 2-3/0 | 2-3/0 |
| 350 | 3/0 | 3/0 | 3/0 | 4/0 | 2-2/0 | 2-3/0 | 2-3/0 | 2-4/0 |
| 400 | 3/0 | 3/0 | 3/0 | 4/0 | 2-2/0 | 2-3/0 | 2-4/0 | 2-4/0 |
| 500 | 4/0 | 4/0 | 4/0 | 2-2/0 | 2-3/0 | 2-4/0 | 500MCM | 1000MCM |
| 600 | 4/0 | 4/0 | 2-2/0 | 2-3/0 | 2-4/0 | 500MCM | 1000MCM | 1000MCM |
| 700 | 4/0 | 4/0 | 2-3/0 | 2-4/0 | 500MCM | 1000MCM | 1000MCM | 1000MCM |
| 800 | 2-2/0 | 2-2/0 | 2-3/0 | 2-4/0 | 1000MCM | 1000MCM | 1000MCM | 1000MCM |
| 900 | 2-3/0 | 2-3/0 | 2-4/0 | 500MCM | 1000MCM | 1000MCM | 1000MCM | 1000MCM |
| 1000 | 2-3/0 | 2-3/0 | 2-4/0 | 1000MCM | 1000MCM | 1000MCM | 1000MCM | |
| 1250 | 2-4/0 | 2-4/0 | 500MCM | 1000MCM | 1000MCM | 1000MCM | | |
| 1500 | 500MCM | 500MCM | 1000MCM | 1000MCM | 1000MCM | | | |
| 1750 | 1000MCM | 1000MCM | 1000MCM | 1000MCM | | | | |
| 2000 | 1000MCM | 1000MCM | 1000MCM | | | | | |

TA-052 764

NOTE: *A. 50 FEET OR LESS.

*B. CABLE SIZE IS BASED ON DIRECT CURRENT (DC), 100% DUTY CYCLE AND EITHER A 4 VOLTS OR LESS DROP OR A CURRENT DENSITY OF NOT OVER 300 CIRCULAR MILS PER AMP.

*C. WELD CABLE INSULATION WITH A VOLTAGE RATING TO WITHSTAND THE OPEN-CIRCUIT VOLTAGE (OCV) OF THE WELDING POWER SOURCE MUST BE USED. WHILE MOST WELDING POWER SOURCES HAVE AN OPEN-CIRCUIT VOLTAGE OF LESS THAN 100 VOLTS, SOME WELDING POWER SOURCES OF SPECIAL DESIGN MAY HAVE HIGHER OPEN-CIRCUIT VOLTAGE.

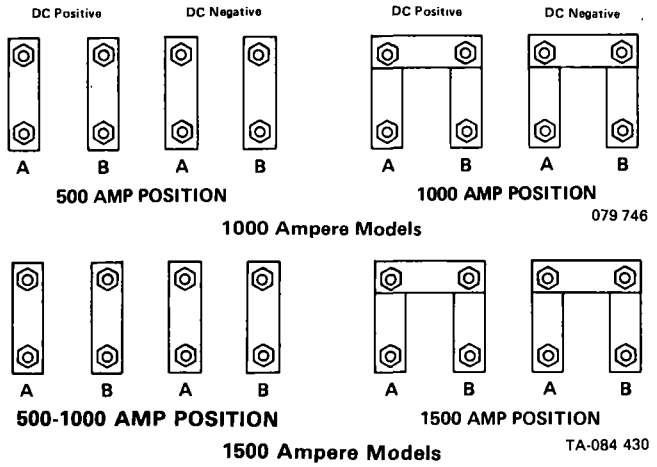



**Figure 3-5. Weld Output Connections**

### C. Weld Output Connections (Figure 3-5)

These units have two separate weld output sections, A and B, that must be considered when making connections.

**CAUTION: ELECTRIC SHOCK can kill.**

- *Do not touch live electrical parts.*
- *Shut down the welding power source and disconnect input power before making weld output connections.*
- *Do not make connections to weld output terminals of the different sections (A and B) unless the bus bars are in place.*

If the positive output terminal of one section (A, for example) is connected to the negative output terminal of the other section (B, for example), two times the normal output voltage will exist between the remaining two output terminals. Consult applicable safety codes.

**IMPORTANT:** *Select the desired polarity before making weld output connections. Choose either dc straight polarity (electrode negative) or reverse polarity (electrode positive).*

1. For 1000 Ampere Models

When the weld output terminals are not bused together, 500 amperes of weld output is available between the A Positive and A Negative output terminals. Simultaneously, 500 amperes of weld output is available between the B Positive and B Negative output terminals.

When the weld output terminals are bused together, 1000 amperes of weld output is available between the A Positive and A Negative or B Positive and B Negative output terminals.

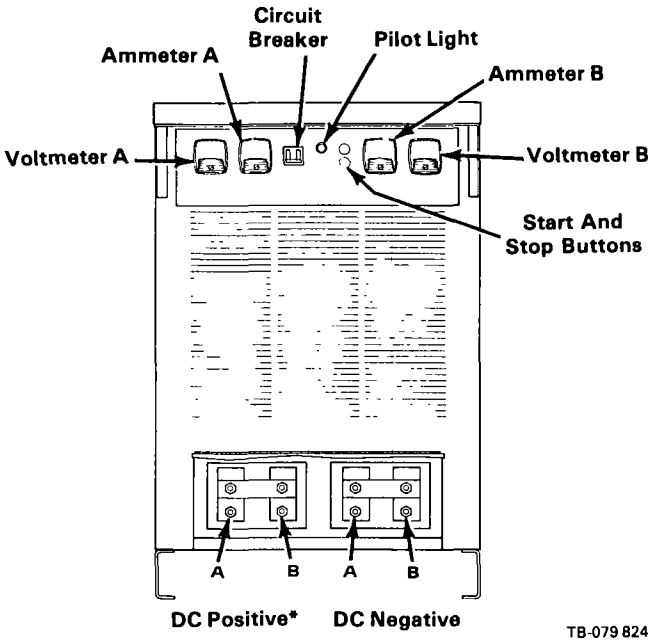
This unit was shipped with the weld output terminals bused together (in the 1000 ampere position; see Figure 3-5).

2. For 1500 Ampere Models

When the weld output terminals are not bused together, 500 amperes of weld output is available between the A Positive and A Negative output terminals. Simultaneously, 1000 amperes of weld output is available between the B Positive and B Negative output terminals.

When the weld output terminals are bused together, 1500 amperes of weld output is available between the A Positive and A Negative or B Positive and B Negative output terminals.

This unit was shipped with the weld output terminals bused together (in the 1500 ampere position; see Figure 3-5).




*1000 Models Illustrated

**Figure 4-1. Front Panel**

### 4-1. POWER CONTROL SWITCH (Figure 4-1)

**CAUTION:** *Depressing the POWER CONTROL STOP button does not remove power from all of the welding power source internal circuitry. Completely terminate all electrical power to the welding power source by employing "machinery lockout procedures" before attempting any inspection or work on the inside of the unit. If the welding power source is connected to a disconnect switch, padlock the switch in an open position. If connected to a fuse box, remove the fuses and padlock the cover in a closed position. If the unit is connected to a circuit breaker, or other disconnecting device without locking facilities, attach a red tag to the device to warn others that the circuit is being worked on.*

Depressing the POWER CONTROL START button will energize the welding power source placing the unit in a ready-to-weld status. Depressing the POWER CONTROL STOP button will shut the welding power source down.

**4-2. OVERLOAD PROTECTION** - Thermostat TP1, located in the main transformer, is wired into the contactor W coil circuit. Should overheating occur, TP1 would open causing the contactor to drop out thereby suspending all operations. If TP1 opens, allow the unit to cool before resuming operations.

Circuit breaker CB protects the welding power source from excessive secondary current draw. Current transformer CT1 and CT2, located in the secondary of the main transformer, sense the secondary current draw. Should overloading occur, CB would open causing the contactor to drop out thereby suspending all operations.

To place the welding power source in a ready-to-weld status should this circuit breaker trip, the circuit breaker should be manually reset. Should the circuit breaker continue to trip after each reset, an internal problem in the circuitry is most probably present. Do not attempt any further welding until the trouble has been remedied.

**4-3. PILOT LIGHT** - The pilot light PL1 indicates when the welding power source is in a ready-to-weld status.

**4-4. METERS** - The meters are provided to monitor the welding operation. They are not intended for exact current or voltage measurements. These meters are internally connected to the output terminals. The voltmeters will indicate the voltage at the output terminals, but not necessarily the actual voltage at the welding arc (due to cable resistance, poor connections, etc.). The ammeters will indicate the current output of the unit.

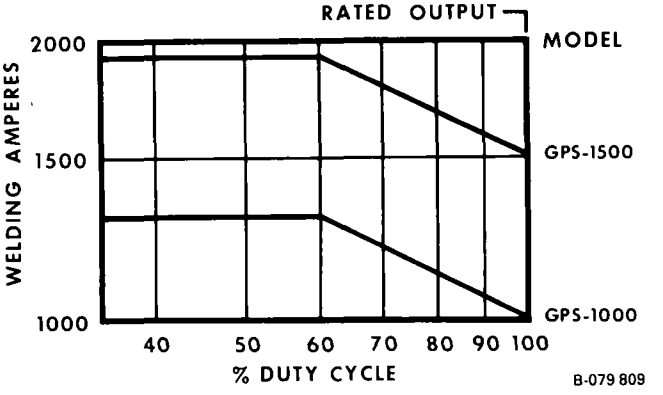



**Figure 4-2. Duty Cycle Chart**

**4-5. DUTY CYCLE** - The duty cycle of a welding power source is the percentage of a ten minute period that a welding power source can safely be operated at a given output. This welding power source is rated at 100 percent duty cycle. This means that the welding power source can be safely operated at rated load continuously. Figure 4-2 enables the operator to determine the safe output of the welding power source at various duty cycles.

**IMPORTANT:** *Exceeding the indicated duty cycle will cause overheating and thereby damage to the welding power source.*

## SECTION 5 - MAINTENANCE

**CAUTION:** *Depressing the POWER CONTROL STOP button does not remove power from all of the welding power source internal circuitry. Completely terminate all electrical power to the welding power source by employing "machinery lockout procedures" before attempting any inspection or work on the inside of the unit. If the welding power source is connected to a disconnect switch, padlock the switch in an open position. If connected to a fuse box, remove the fuses and padlock the cover in the closed position. If the unit is connected to a circuit breaker, or other disconnecting device without locking facilities, attach a red tag to the device to warn others that the circuit is being worked on.*

**IMPORTANT:** *Periodically inspect the labels on this unit for legibility. All labels must be maintained in a clearly readable state and replaced when necessary. See the Parts List for part number of labels.*

**5-1. FAN MOTOR** - All models are equipped with an exhaust fan and rely on forced draft for adequate cooling. The fan motor is manufactured with lifetime-lubricated sealed ball bearings and no attention should be required.

**5-2. INTERNAL CLEANING** - Occasional blowing out or vacuuming of the dust and dirt from around the internal components is recommended. This should be done periodically depending upon the location of the unit and the amount of dust and dirt in the atmosphere. The welding power source outer enclosure should be removed and a clean, dry air stream or vacuum suction should be used for this cleaning operation.

**5-3. CONTROL CIRCUIT PROTECTION** - The entire control circuit of the welding power source is protected by a 600 volt, 3 ampere, cartridge type fuse F1. This fuse is located under the top cover beside contactor W. Should this fuse open, the welding power soure would completely shut down.

## SECTION 6 - TROUBLESHOOTING

It is assumed that proper installation has been made, according to Section 3 of this manual, and that the welding power source has been functioning properly until this trouble developed.

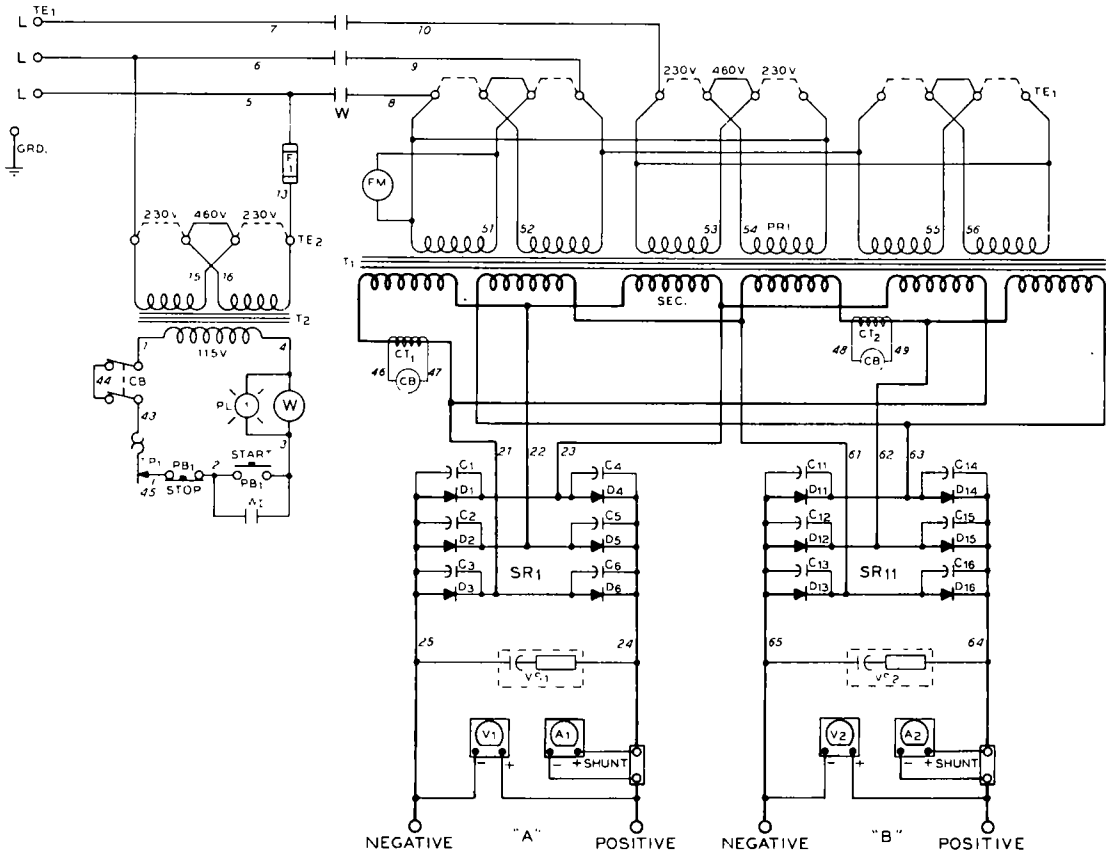
Use this chart in conjunction with the circuit diagram while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, the nearest Factory Authorized Service Station should be contacted. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly followed.

**CAUTION:** *Hazardous voltages are present on the internal circuitry of the welding power source as long as power is connected to the unit. Disconnect power before attempting any inspection or work on the inside of the unit. Troubleshooting of internal circuitry should be performed by qualified personnel only.*

The following chart is designed to diagnose and provide remedies for some of the troubles that may develop in this welding power source.

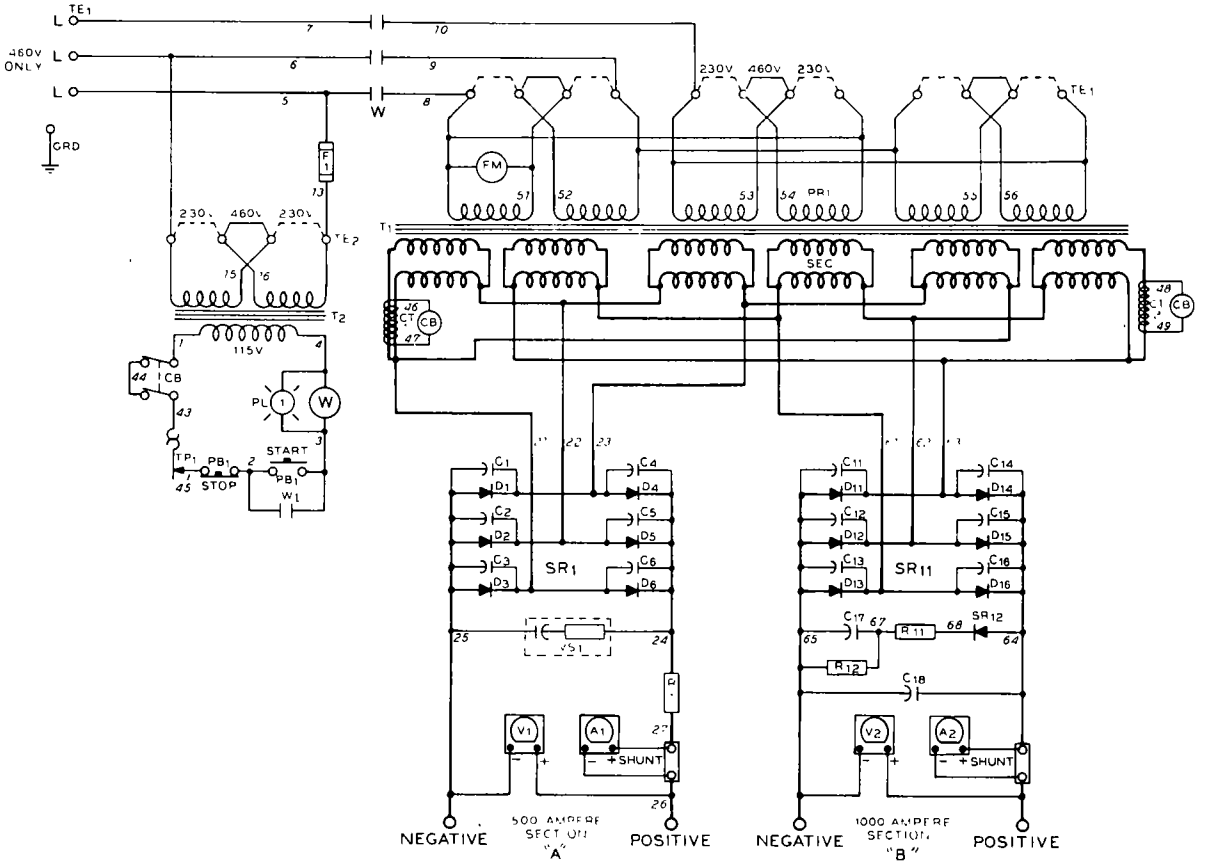
| TROUBLE | PROBABLE CAUSE | REMEDY |
|---|---|---|
| No output. | Thermostat TP1 open. | Allow unit a cooling period. |
| | | Replace defective TP1. |
| | Circuit breaker CB open. | Reset CB. |
| | | Replace defective CB. |
| | Fuse F1 is blown. | *Replace defective F1. |

*If it becomes necessary to replace any fuse in the welding power source, ensure that a fuse of the proper size, type, and rating is used.



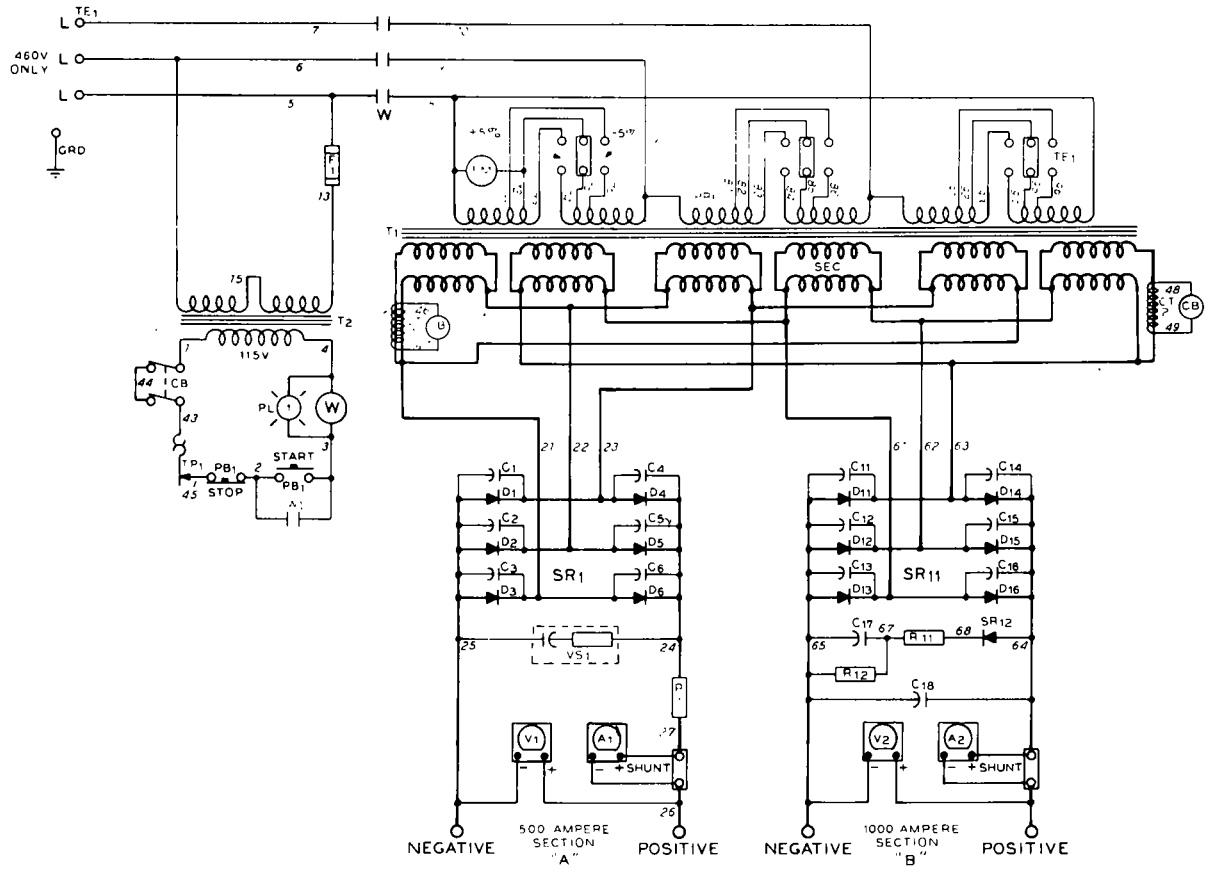

**Circuit Diagram No. B-082 509**

**Figure 6-1. Circuit Diagram For 1000 Models**




**Circuit Diagram No. B-083 538-A**

**Figure 6-2. Circuit Diagram For 1500A Models**

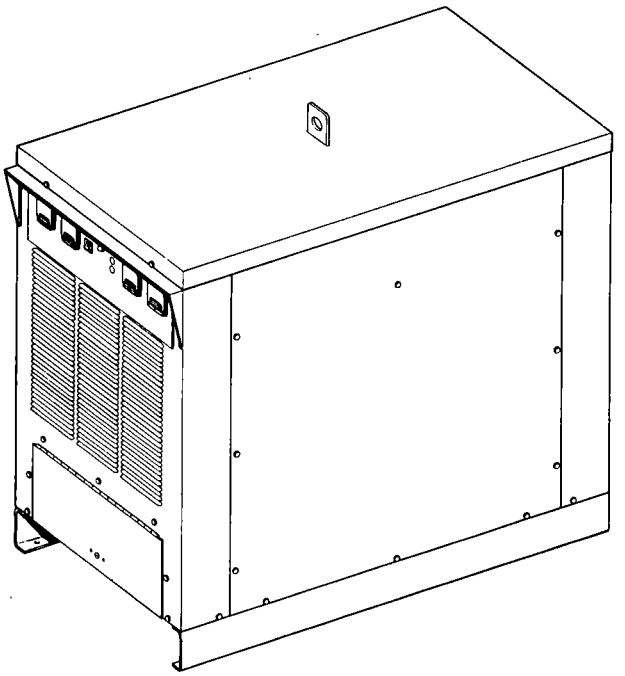



**Circuit Diagram No. B-083 535-A**

**Figure 6-3. Circuit Diagram For 1500V Models**

October 1981 FORM: OM-267C

Effective With Serial No. JB522183



# PARTS LIST

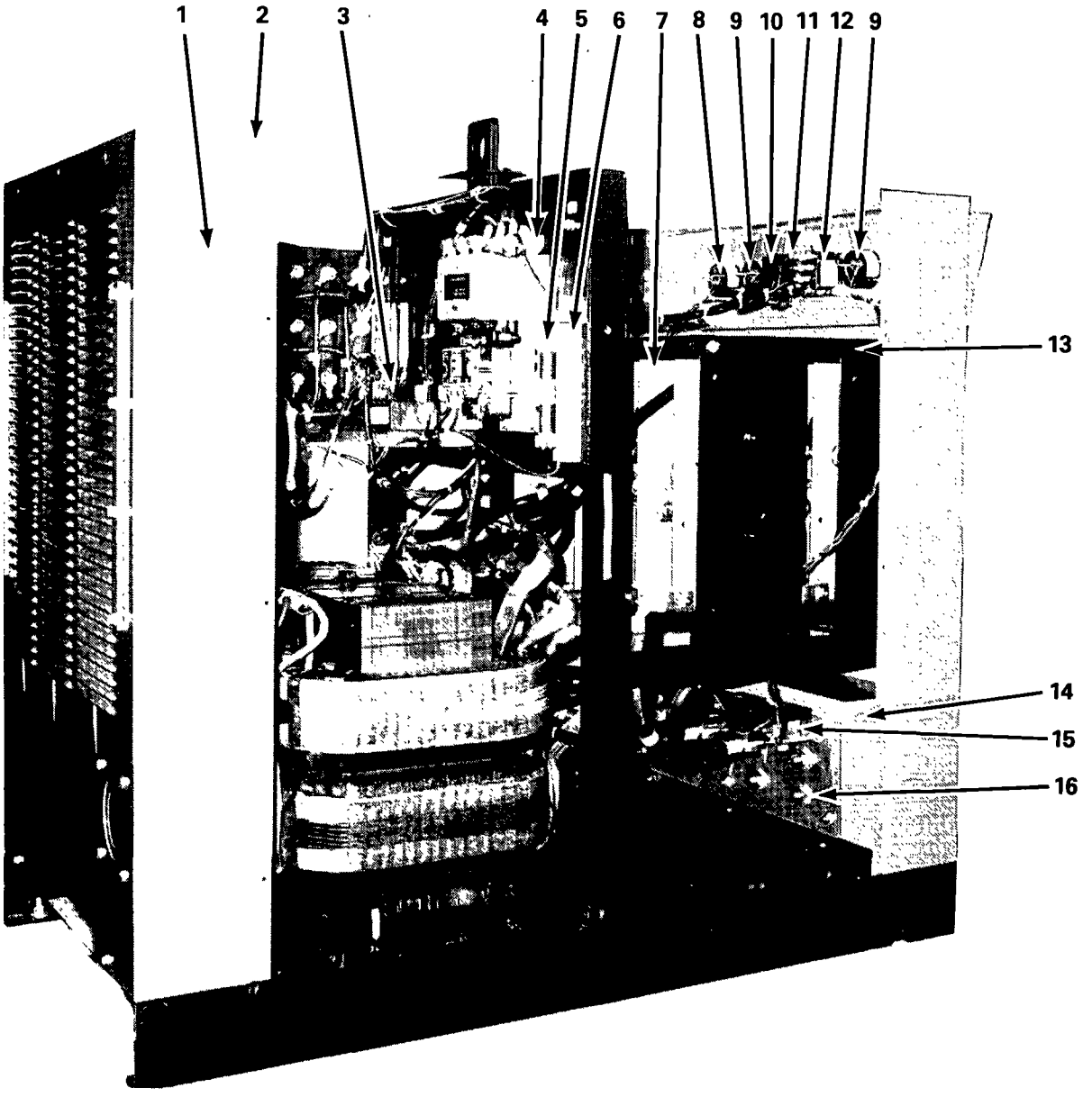



**Figure A — Left Side View**

| Item No. | Dia. Mkgs. | Part No. | Description | Quantity Model 1000 | 1500A | 1500V |
|---|---|---|---|---|---|---|
| **Figure A** | | | **Left Side View** | | | |
| 1 | | +059 572 | COVER, opening - exit cable | 1 | 1 | 1 |
| 2 | | 070 558 | PANEL, rear | 1 | 1 | 1 |
| 3 | T2 | 036 630 | TRANSFORMER, control 100 VA 115-230/460 | 1 | 1 | 1 |
| 4 | W | 048 597 | CONTACTOR, 3 pole 110-120/208-240 (consisting of) | 1 | | 1 |
| 4 | W | 004 104 | CONTACTOR, 3 pole 210 amp 600 V w/115 VAC (consisting of) | | 1 | |
| | | 048 599 | . COIL, 115/230 volts | 1 | | 1 |
| | | 004 259 | . COIL, 120 volts ac | | 1 | |
| | | *048 600 | . KIT, point - contact | 1 | | 1 |
| | | *004 258 | . KIT, point - contact | | 1 | |
| | W1 | 048 731 | INTERLOCK, contactor - normally open | 1 | 1 | 1 |
| 5 | F1 | *604 259 | FUSE, cartridge 30 amp 600 volts | 1 | 1 | 1 |
| 6 | | 012 638 | HOLDER, fuse - cartridge 30 amp 600 volts | 1 | 1 | 1 |
| 7 | SR1,11 | 079 827 | RECTIFIER, silicon diode (consisting of) | 2 | | |
| 7 | SR1 | 079 827 | RECTIFIER, silicon diode (consisting of) | | 1 | 1 |
| | VS1,2 | 024 471 | . SUPPRESSOR, 1 uf 2.7 ohm | 1 | | |
| | VS1 | 024 471 | . SUPPRESSOR, 1 uf 2.7 ohm | | 1 | 1 |
| | | 037 157 | . DIODE, rectifier 275 amp 250 volts straight polarity | 12 | 12 | 12 |
| | | 031 689 | . CAPACITOR, ceramic 0.01 uf 500 volts | 6 | 6 | 6 |
| 7 | SR11 | 045 586 | RECTIFIER, silicon diode (consisting of) | | | 1 |
| | | 031 689 | . CAPACITOR, ceramic 0.01 uf 500 volts | | | 6 |
| | | 037 156 | . DIODE, rectifier 275 amp 250 volts straight polarity | | | 18 |
| 8 | V1,2 | 025 638 | METER, volts dc 0-100 scale | 2 | 2 | 2 |
| 9 | A1,2 | 059 118 | METER, amp dc 50 MV 0-800 scale | 2 | | |
| 9 | A1 | 059 118 | METER, amp dc 50 MV 0-800 scale | | 1 | 1 |
| 9 | A2 | 044 104 | METER, amp dc 50 MV 0-1.5K scale | | 1 | 1 |
| 10 | PB1 | 011 636 | SWITCH, push button - start - stop 60 amp 110 volts | 1 | 1 | 1 |
| 11 | PL1 | *027 629 | BULB, incandescent - slide base 120 volts | 1 | 1 | 1 |
| | | 027 631 | HOUSING, light - slide base 125 volts | 1 | 1 | 1 |
| | | 027 628 | LENS, light - red clear | 1 | 1 | 1 |
| 12 | CB | 034 945 | CIRCUIT BREAKER, manual reset 2P 5 amp 240 volts ac | 1 | 1 | 1 |
| 13 | | 059 563 | BAFFLE, air - top rectifier | 1 | 1 | 1 |
| 14 | | 059 616 | BRACKET, mounting - terminal board | 1 | 1 | 1 |
| 15 | Shunt | 079 388 | SHUNT, meter 50 MV 800 amp | 1 | 1 | 1 |
| 15 | Shunt | 072 425 | SHUNT, meter 50 MV 1500 amp | | 1 | 1 |
| 16 | | 059 567 | TERMINAL, power - output (consisting of) | 1 | 1 | 1 |
| | | 601 841 | . NUT, brass - hex jam 5/8-11 | 16 | 16 | 16 |
| | | 601 842 | . NUT, brass - hex full 5/8-11 | 8 | 8 | 8 |
| | | 059 566 | . TERMINAL BOARD | 2 | 2 | 2 |
| | | 038 909 | . STUD, brass 5/8-11 x 3 | 8 | 8 | 8 |
| | | 602 249 | . WASHER, flat - SAE 5/8 | 8 | 8 | 8 |
| | | 602 219 | . WASHER, lock - external tooth 5/8 | 8 | 8 | 8 |
| | | 038 032 | . BUS BAR | 4 | 4 | 4 |

*Recommended Spare Parts.
+When ordering a component originally displaying a precautionary label, the label should also be ordered.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.

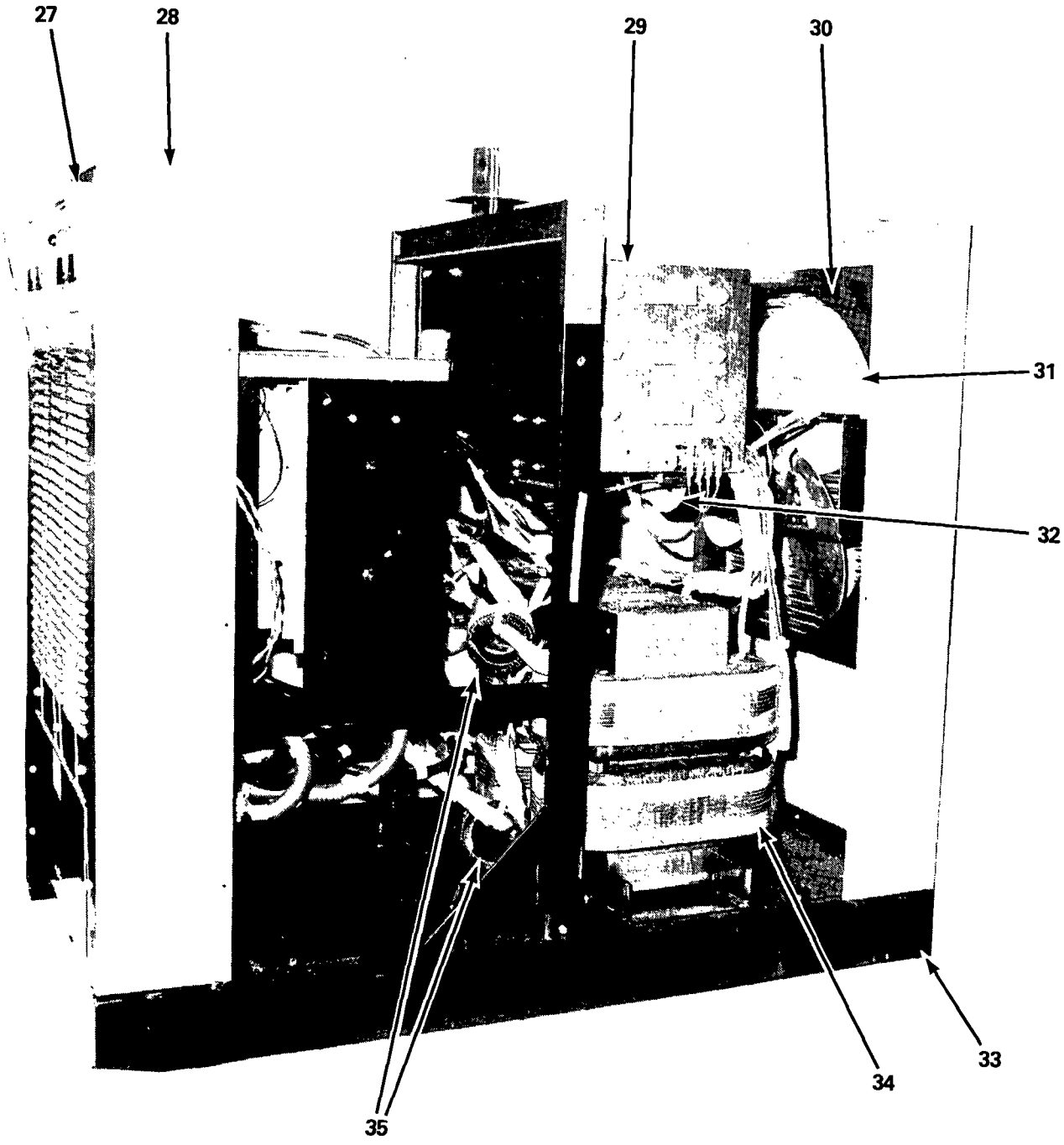



Figure B — Right Side View

| Item No. | Dia. Mkgs. | Part No. | Description | Quantity Model 1000 | 1500A | 1500V |
|---|---|---|---|---|---|---|
| **Figure B** | | | **Right Side View** | | | |
| 27 | | 009 139 | VISOR, front - top | 1 | 1 | 1 |
| 28 | | 070 556 | PANEL, front | 1 | 1 | 1 |
| | R11 | 030 691 | RESISTOR, carbon 1 watt 4700 ohm | | 1 | 1 |
| | R12 | 604 288 | RESISTOR; WW fixed 10 watt 2 ohm | | 1 | 1 |
| | SR12 | 083 719 | RECTIFIER, silicon - control | | 1 | 1 |
| | C17 | 031 640 | CAPACITOR, electrolytic 500 uf 200 volts dc | | 1 | 1 |
| | | 601 375 | RING, mounting - capacitor | | 2 | 1 |
| | C18 | 031 683 | CAPACITOR, paper oil 0.5 uf 200 volts dc | | | 1 |
| 29 | TE1 | 059 555 | TERMINAL, primary (consisting of) | 1 | 1 | |
| 29 | TE1 | 044 098 | TERMINAL, primary (consisting of) | | | 1 |
| | | 038 897 | . TERMINAL BOARD, primary | 1 | 1 | |
| | | 044 099 | . TERMINAL BOARD, primary | | | 1 |
| | | 602 221 | . WASHER, lock - internal tooth 3/8 | 12 | 12 | 18 |
| | | 010 910 | . WASHER, flat - SAE 3/8 | 12 | 12 | 18 |
| | | 601 837 | . NUT, brass - hex 3/8-16 | 36 | 36 | 54 |
| | TE2 | 038 621 | . BLOCK, terminal 30 amp 4 pole | 1 | 1 | |
| | | 038 804 | . STUD, brass 3/8-16 x 2-1/2 | 12 | 12 | 18 |
| | | 038 898 | . LINK, terminal - connecting | 6 | 6 | |
| | | 038 620 | . LINK, jumper - terminal block 30 amp | 1 | 1 | |
| | | 044 100 | . LINK, terminal - connecting | | | 3 |
| | R1 | 083 640 | RESISTOR, grid | 1 | 1 | 1 |
| 30 | | 083 637 | WINDTUNNEL, 20 inch | 1 | 1 | 1 |
| | | 014 425 | BAR, support - windtunnel | 2 | 2 | 2 |
| 31 | | 032 616 | BLADE, fan 60 Hz 20 inch 3 wing 21 deg | 1 | 1 | 1 |
| 32 | FM | 032 605 | MOTOR, 1/4 hp 230 volts ac 1625 rpm | 1 | 1 | 1 |
| | | 059 983 | BUS BAR, jumper - secondary | 2 | 2 | 2 |
| 33 | | 070 644 | BASE | 1 | 1 | 1 |
| 34 | T1 | 079 718 | TRANSFORMER, power - main (consisting of) | 1 | | |
| 34 | T1 | 070 897 | TRANSFORMER, power - main (consisting of) | | 1 | |
| 34 | T1 | 044 147 | TRANSFORMER, power - main (consisting of) | | | 1 |
| | | **079 719 | . TRANSFORMER SUBASSEMBLY | 1 | | |
| | | **059 576 | . TRANSFORMER SUBASSEMBLY | | 1 | 1 |
| | | **079 529 | . COIL, primary/secondary | 6 | | |
| | | **070 724 | . COIL, primary/secondary | | 6 | |
| | | **045 971 | . COIL, primary/secondary | | | 6 |
| 35 | CT1,2 | 080 075 | TRANSFORMER, current 300/5 | 2 | | 2 |
| 35 | CT1,2 | 036 612 | TRANSFORMER, current 800/5 | | 2 | |
| | TP1 | 026 181 | THERMOSTAT, normally closed (located in coils) | 6 | 6 | 6 |
| | | 071 624 | PANEL, side | 2 | 2 | 2 |
| | | 070 555 | COVER, top | 1 | 1 | 1 |
| | | 010 014 | CLAMP | | 2 | 2 |
| | | 026 627 | GASKET, lifting eye - cover | 1 | 1 | 1 |

**Replace at Factory or Factory Authorized Service Station.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBERS WHEN ORDERING REPLACEMENT PARTS.